

Characterizing the Risk of Atrial Fibrillation in Cardiac Patients with Exceptional Electrocardiogram Phenotypes

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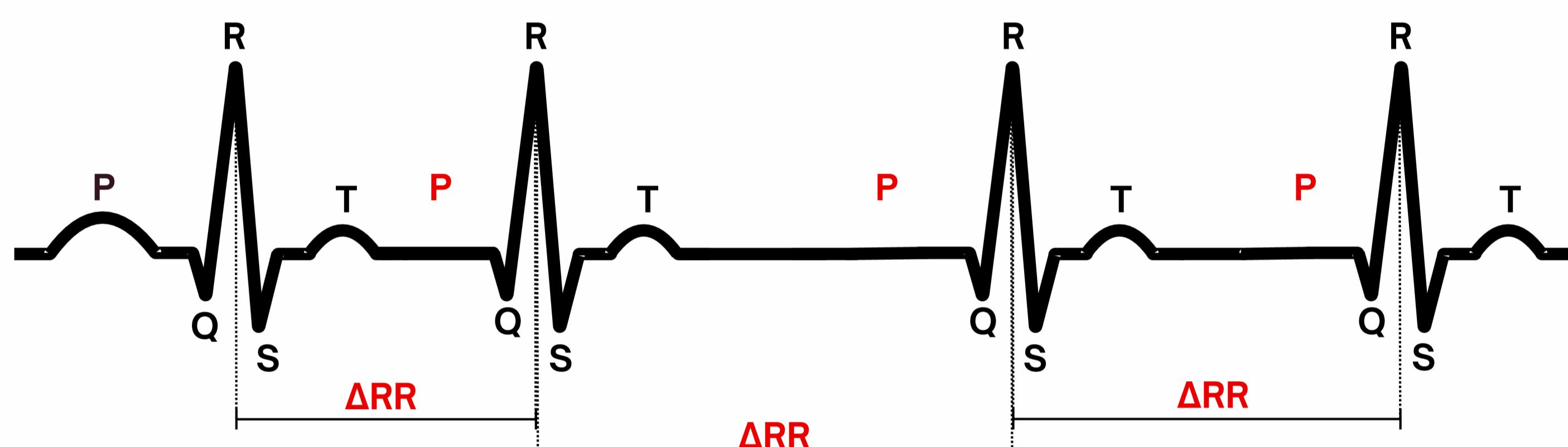
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1 Problem Statement

- Atrial Fibrillation (AF):** Cardiac arrhythmia that affects up to 50% of patients after cardiac surgery and recurs after experiencing.
- It causes Increased & irregular heart rhythm → Blood clots → Strokes
- Current method:* reactive & black-box.
- Wanted:* predictive & transparent → Gain trust of medical workers.
- Goal:* Preventive medication → Stratified treatment to risk groups.
- RED** indicates AF characteristics in ECGs: irregular ΔRR and missing P.



2 Methodology

- Exceptional Model Mining (EMM):** Automated detection of risk groups with exceptional behavior, i.e. abnormal ECG morphology.
- Abnormal ECG morphology in Lead II: irregular ΔRR and missing P.
- Reduce false discoveries with an entropy and a precision function.
- Targets get transformed into heartbeat feature statistics.
- Datasets: ECG signals & Electronic health records & Proprietary alarms

patients	descriptors										targets		
	AGE	blood	smoke	alcohol	eye	...	True	False	False	7.6	hb1	hb2	hb
56	↑	used	uses	never	...	True	False	False	7.6	ECG	ECG	ECG	...
43	↓	never	uses	never	...	True	True	True	7.4	ECG	ECG	ECG	...
89	↑	never	used	never	...	False	False	True	8.6	ECG	ECG	ECG	...
77	↑	uses	uses	used	...	True	True	False	7.2	ECG	ECG	ECG	...
56	↓	never	never	never	...	False	True	False	6.7	ECG	ECG	ECG	...

3 Results

- Deployed on 230 cardiac patients at Catharina Hospital
- Subgroup descriptions on Electronic Health Records
- Eleven methods are deployed → 165 subgroups found
- All subgroups are discussed and evaluated with domain experts
- We identified several **known and new risk factors**
- Advice:** Administer preventive medication to patients ...

- a assisted by the heart-lung machine that also have acidic blood
- b with blood clotting problems that need cefazolin admission
- c with high chloride levels
- d with blood clotting problems that need Ringer's lactate admission
- e that get Alfentanil administered

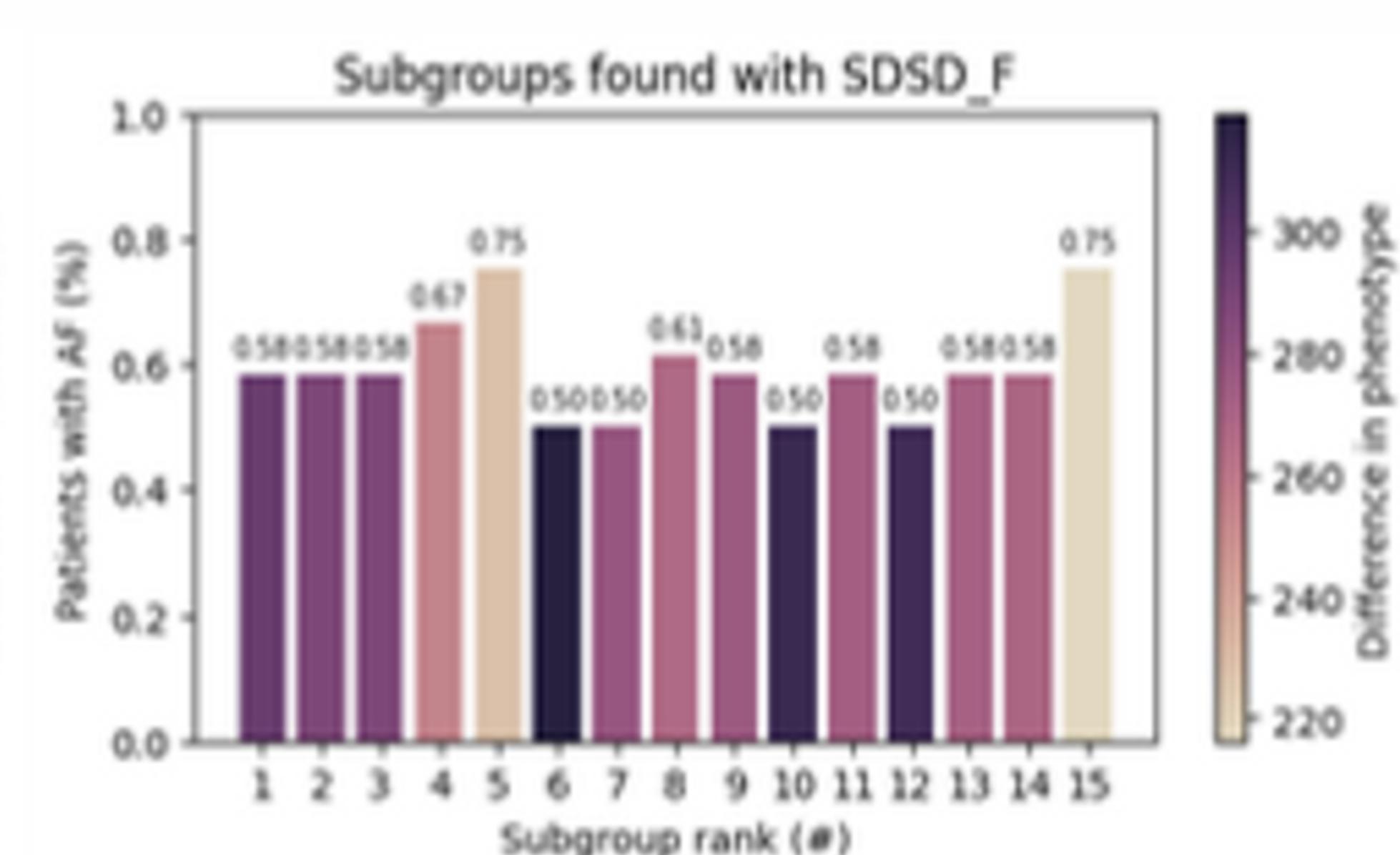
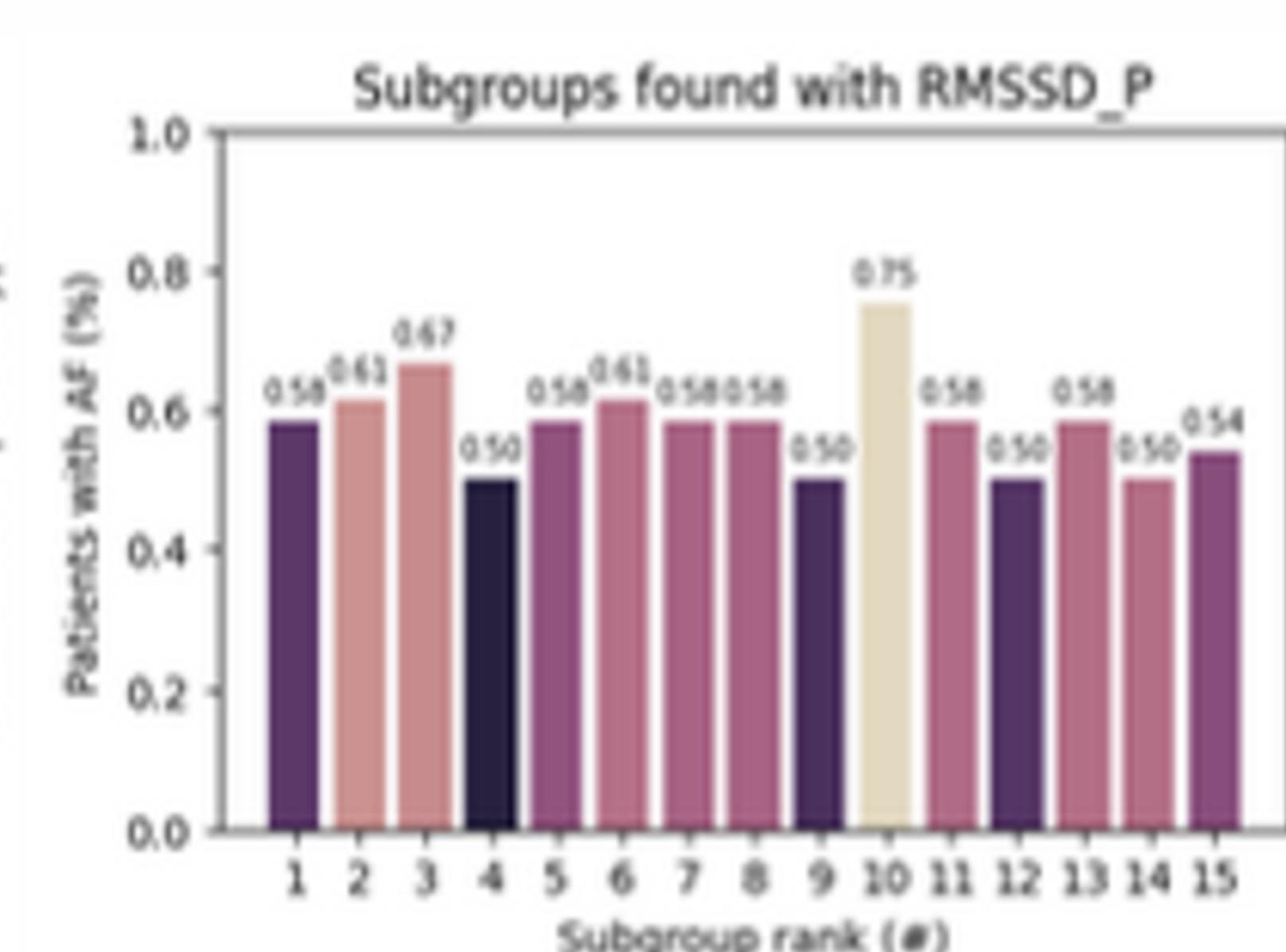
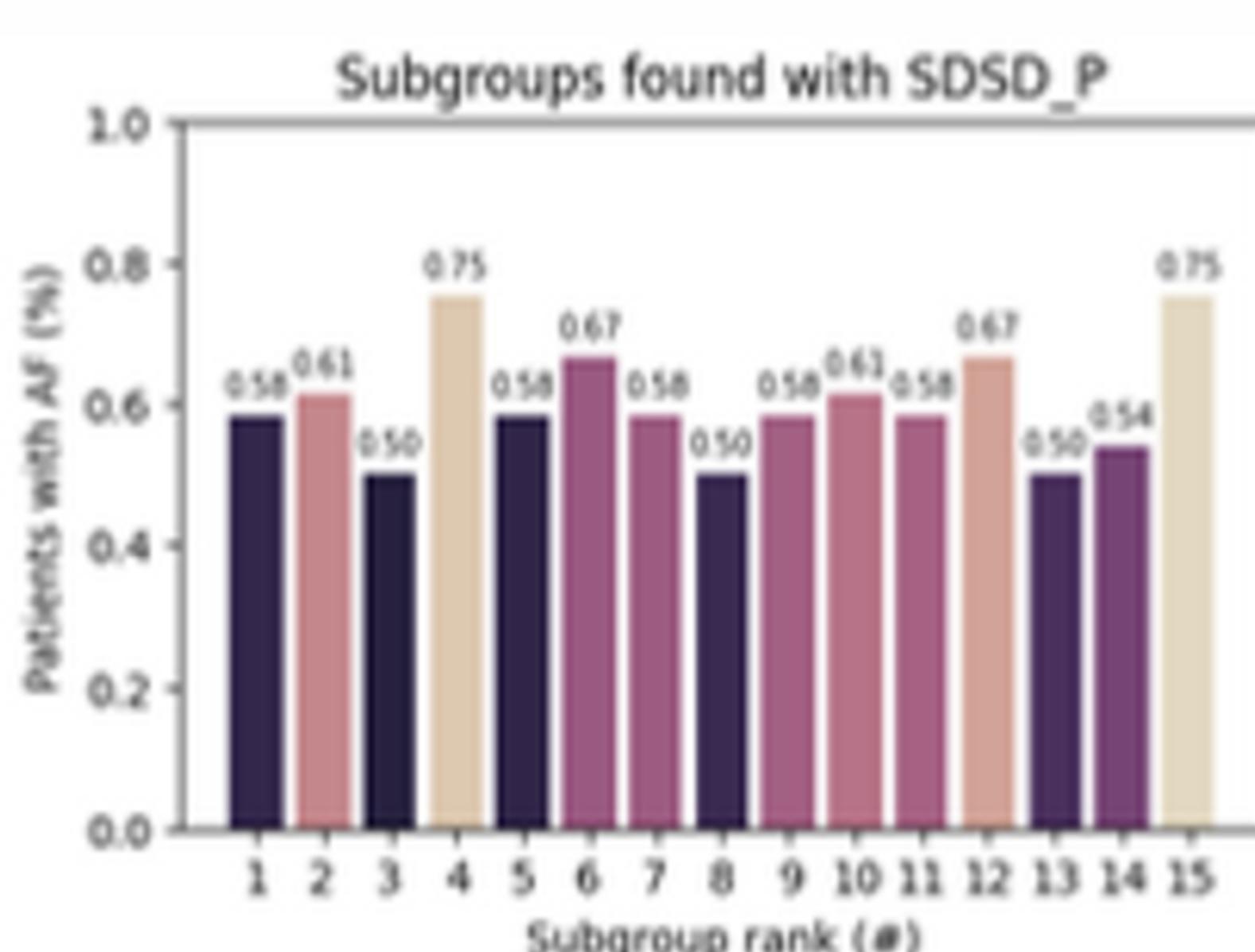
4 Future Work

Medical direction

- Follow-up studies on hypotheses: Alternatives to Alfentanil (set up)
- Repeat experiment at more hospitals
- Generalizing approach to other (cardiac) diseases

Technical direction

- Combining data from multiple leads in the target space
- Deploying EMM as predictive method
- Application of EMM on time segments
- Exceptionality metric for clinical uses



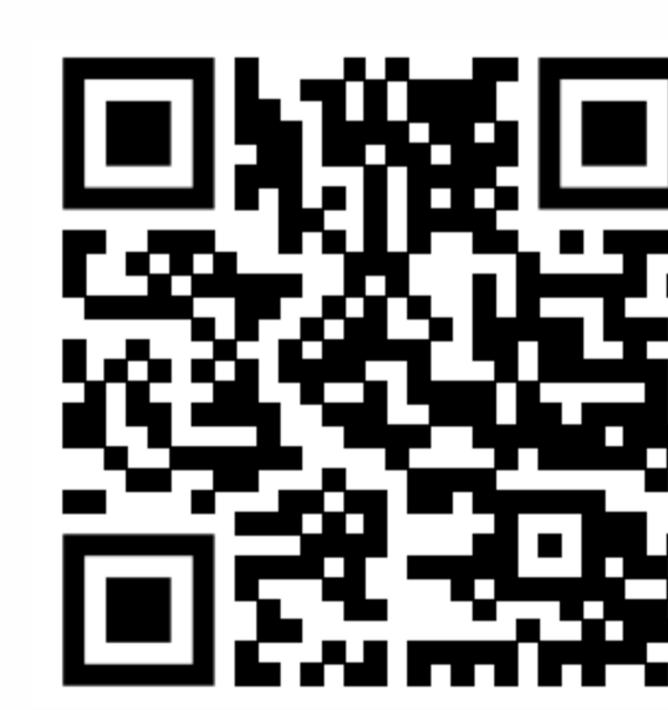
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catharina een santeon ziekenhuis

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Paper



Source Code

Materials